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Health Status and Hospital Utilization of Recent Immigrants to New York City[1]

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Background. **This paper examines hospital utilization, estimated hospital costs, and mortality rates for U.S.-born, foreign-born, and Puerto Rican-born persons residing in New York City.**

Methods. **We conducted a multivariate regression analysis using New York City neighborhoods as the unit of analysis. We utilized data from the Statewide Planning and Research Cooperative System data set and from the 1997 Housing and Vacancy Survey. We also examined mortality rates using 1990 death certificate data and decennial census data.**

Results. **The foreign-born are much less likely to be hospitalized for most major categories of illness and have lower mortality rates than either U.S.-born or Puerto Rican-born New Yorkers. The life expectancy at 1 year of age of the foreign-born is 4 years longer than for U.S.-born persons and 6 years longer than Puerto Rican-born persons. We estimate that the overall cost of providing hospital-based care to the foreign-born was $611 million dollars less than the cost of providing hospital-based care to an equivalent number of U.S.-born persons in 1996.**

Conclusion. **The foreign-born in New York City appear to be healthier and consume fewer hospital resources than U.S.-born populations. It is possible that the cost of hospital utilization would be lower still if the foreign-born population had better access to ambulatory and preventive services.**

Key Words: **immigration and emigration; mortality; health status; health services accessibility.**

INTRODUCTION

In 1990, almost 34% of New York City's population was composed of persons born outside of the United States or its territories [*1*]. By 1999, the proportion of foreign-born persons residing in New York City had grown to almost 40% [*2*]. The majority of foreign-born persons are uninsured and low-income foreign-born persons are ineligible for publicly funded medical care by law, in part because of an overall perception that caring for immigrants is expensive [*3,4*].

Nevertheless, good health outcomes among foreign-born persons have been reported in the medical literature, suggesting lower medical utilization among this population [*5*]. Recent immigrants were found to have lower overall self-reported rates of disease and ranked higher in health status measurement scales than either U.S.-born persons or immigrants who have resided in the United States 10 years or more [*6*].

Other countries have reported similar findings. For instance, health care utilization rates may be lower and life expectancy higher among legal immigrants to Canada than native-born Canadians [*7*].

Studies indicating that immigrants are generally healthier than native-born persons have led to the "healthy migrant" hypothesis, which purports that immigrants and other foreign-born populations are a self-selected healthy population, due to the necessity of health for undertaking strenuous travel. Lower rates of chronic disease in developing countries may contribute to this phenomenon.

Federal law limits eligibility for federally funded medical care programs to persons who immigrated prior to 1996 or who became disabled while residing in the United States [*8*]. Those who legally immigrated after 1996 may only receive government benefits after 5 years of residence in the United States, complicating access issues in an already underinsured population [*9–11*]. If foreign-born populations are indeed healthier than U.S.-born populations, it is likely that immigrants consume fewer medical resources than U.S.-born persons. Therefore, national immigrant health

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policy—which is based in part on fears that immigrants disproportionately consume local or national health resources [*3,4,10*]—should be reexamined if immigrants in fact consume fewer health resources than nonimmigrants.

This investigation examines the health status of New York City's foreign-born populations, their patterns of health service utilization, and the cost of providing hospital-based care to this population in New York City. Using a small area analysis [*12*], we undertake an empirical investigation of the determinants of hospital use among immigrants, examining the roles that income, gender, race, ethnicity, years of residence in the United States, and housing conditions play among foreign-born and U.S.-born persons. We also examine whether traditional risk factors for disease in U.S.-born populations remain predictors of disease in the foreign-born and estimate the cost of providing hospital care to immigrant populations.

METHODS

Overview and Definitions

To ascertain the health status of foreign-born persons residing in New York City, we conducted two distinct investigations, one examining hospitalization rates and the other examining mortality rates. In the first, we examined hospitalization records to determine whether foreign-born persons are hospitalized at a higher or lower rate than U.S.-born persons or persons born in Puerto Rico, a U.S. territory. In this ecological analysis, we compared hospitalization rates among 55 neighborhoods in New York City using multivariable linear regression models. Using the percentage difference in hospitalization rates between U.S.-born and foreign-born populations, we then estimated the overall difference in hospital costs between these populations. Since hospital rates among the foreign-born either may be attributed to a superior health status or reduced access to care, we also analyzed mortality data by country of birth using standard demographic methods.

Our analysis included all foreign persons, including temporary workers and full-time residents, regardless of whether they were documented or undocumented. Persons born in the continental United States and Hawaii were considered U.S.-born and persons born in U.S. territories were analyzed separately.

Hospital Care Utilization and Morbidity Analysis

We obtained population data from the 1996 Housing and Vacancy Survey (HVS)—a survey of 10,000 households in New York City that is conducted every 3 years by the United States Bureau of the Census [*13*]. The survey was only administered to persons 18 years and over and sample weights were not available for geographic regions smaller than "sub-borough areas," neighborhoods that consist of multiple census tracts.

Overall and diagnosis-specific hospitalization rates and charges were calculated using 1996 hospital discharge data from the Statewide Planning and Research Cooperative System (SPARCS) in the numerator and 1996 HVS data in the denominator. The SPARCS data set provides details of utilization and health status—such as diagnoses, age, race, and gender—for every nonfederal hospitalization in New York State. Misclassification bias was minimized by examining only major diagnostic categories and total admissions.

Country of birth is not routinely recorded in most medical records, including hospitalization data. By translating patient addresses into the area of residence for each patient, we were able to analyze community-based trends in hospital use and outcomes for foreign-born and U.S.-born persons living in specific geographically defined regions of New York City.

Using New York City's 55 neighborhoods as our unit of analysis, we examined demographic and socioeconomic covariates of average hospitalization rates by neighborhood. We used multivariable models to distinguish the independent effect of the proportionate population level of foreign-born persons residing in the neighborhood on hospitalization rates in that neighborhood, exploiting the fact that foreign-born persons tend to cluster into ethnic enclaves (demographically similar geographically confined communities).

Analyses were conducted using the Statistical Package for the Social Sciences version 9 (SPSS Inc., Chicago, IL). With the exception of total household income, all variables were converted to area-specific proportions by dividing the parameter in question by the total population. These proportions were then entered into the model as continuous variables. Thus, the proportion of females, foreign-born, black, Asian, and Latinos and persons born in specific region of the world were tabulated for each of the 55 neighborhoods under study and included as independent variables. The dependent variable was the rate of hospitalization per 100 persons, which is calculated by dividing the total number of hospitalizations in a neighborhood by the total population of that neighborhood. When independent variables are eliminated, the simplified equation takes the form

$$R_f = 0.127 - 0.061 \cdot P_f,$$

where R_f is the hospitalization rate of foreign-born persons and P_f is the proportion of foreign-born persons residing in New York City.

Since the median age of a particular neighborhood masks a wide variation in persons of different ages, it was necessary to examine age effects using a separate model for four different age groups. The age intervals used in the analysis of hospitalization rates were 18 to

25, 25 to 45, 45 to 65, and 65 years and older. To improve the statistical power of our analysis, we analyzed 18- to 45-year-olds together in a "base-case" analysis, in which multiple determinants of health were examined.

Mortality Analysis

Mortality rates were calculated using data from the 1990 United States Census Public Use Micro-Sample (PUMS) and 1990 Vital Statistics data from the New York City Department of Health. The error associated with smaller but more recent census samples, such as the Current Population Survey, was prohibitively large for a mortality analysis in New York City, and the latest year for which mortality data were available at the time of the study was 1998.

Age-specific mortality rates were determined by dividing the number of deaths among foreign-born persons, U.S.-born persons, and Puerto Ricans by the respective numbers of persons residing in New York City using 1990 New York City Department of Health Vital Statistics Data and the 1990 PUMS from the United States Bureau of the Census. Age-standardized rates were obtained using the 1990 New York City population as a standard population.

Life expectancy was calculated using standard demographic methods [*14,15*] with three exceptions. First, we used a large initial age interval because there were small numbers of deaths for persons between the ages of 1 and 25. Second, life expectancy was calculated at 1 year of age since subjects were born outside of the United States. Third, we assumed that persons over the age of 75 would have a life expectancy of 11.1 years (the life expectancy at 75 in the United States) regardless of the country of origin [*16*].

Cost of Hospitalization

Using total hospital charges for each age interval, we estimated the total hospital charges saved for foreign-born persons using the formula:

$$\frac{(R_f - R_n)}{R_i} \cdot C_t,$$

where R_n is the rate of hospitalization of native-born persons and C_t is the total annual charge for services reported by New York City hospitals. The value for R_f was determined using the simplified regression formula above and a value of 0.35 for P_f.

We converted charges to costs using cost-to-charge ratios derived from the Health Care Financing Administration's Medpar data set [*17,18*]. Data limitations prevented us from examining the proportion of foreign-born persons residing in a neighborhood as an independent predictor of hospital charges. Therefore, it was necessary to assume that per capita hospital charges were similar for U.S.-born and foreign-born persons, which would not hold true if the severity of disease differed between the foreign-born and U.S.-born persons.

TABLE 1

Demographic Characteristics of New Yorkers by Place of Birth[a]

	Native-born	Foreign-born	New York City
Median age (years)	43	42	43
Median income	$37,070	$33,500	$34,920
Percentage female	56	47	51
Percentage Hispanic	13	33	26
Percentage Black	36	31	31
Percentage White	63	48	59
Percentage Asian	2	20	9

[a] Does not include "not reported" cases.

Source: United States Bureau of the Census, 1996 Housing and Vacancy Survey.

RESULTS

Summary measures of demographic characteristics for New York City residents available are presented in Table 1. Approximately 13% of the persons sampled in the HVS did not report their country of birth.

Hospitalization among 18- to 45-Year-Olds (Base-Case Analysis)

In New York City neighborhoods, hospitalization rates among 18- to 45-year-olds varied from approximately 5.5 hospitalizations per 100 residents per year (the Upper East Side in Manhattan) to 20 hospitalizations per 100 residents per year (Morrisania in the Bronx) in 1996. Foreign-born persons were represented in all neighborhoods, comprising between just over 10% of the population of the Upper East Side in Manhattan to just under 80% of the population of Jackson Heights in Queens. Figure 1 illustrates the relationship between the percentage of foreign-born persons living in a neighborhood (pie chart) and the hospitalization rate (darker colored neighborhoods have a higher rate of hospitalization). Of the 27 neighborhoods with lower than average hospitalization rates, 20 had foreign-born populations above the mean for New York City.

In univariate analyses, total household income, gender, race, ethnicity, country of origin, and overcrowding were all significantly correlated with hospitalization rates (see Table 2). Increasing percentages of foreign-born occupants in a neighborhood predicted lower rates of hospitalization for infectious disease, cancer, circulatory conditions, mental illness, and nervous system conditions (data not shown). Hospitalization rates for digestive conditions, however, were sim-

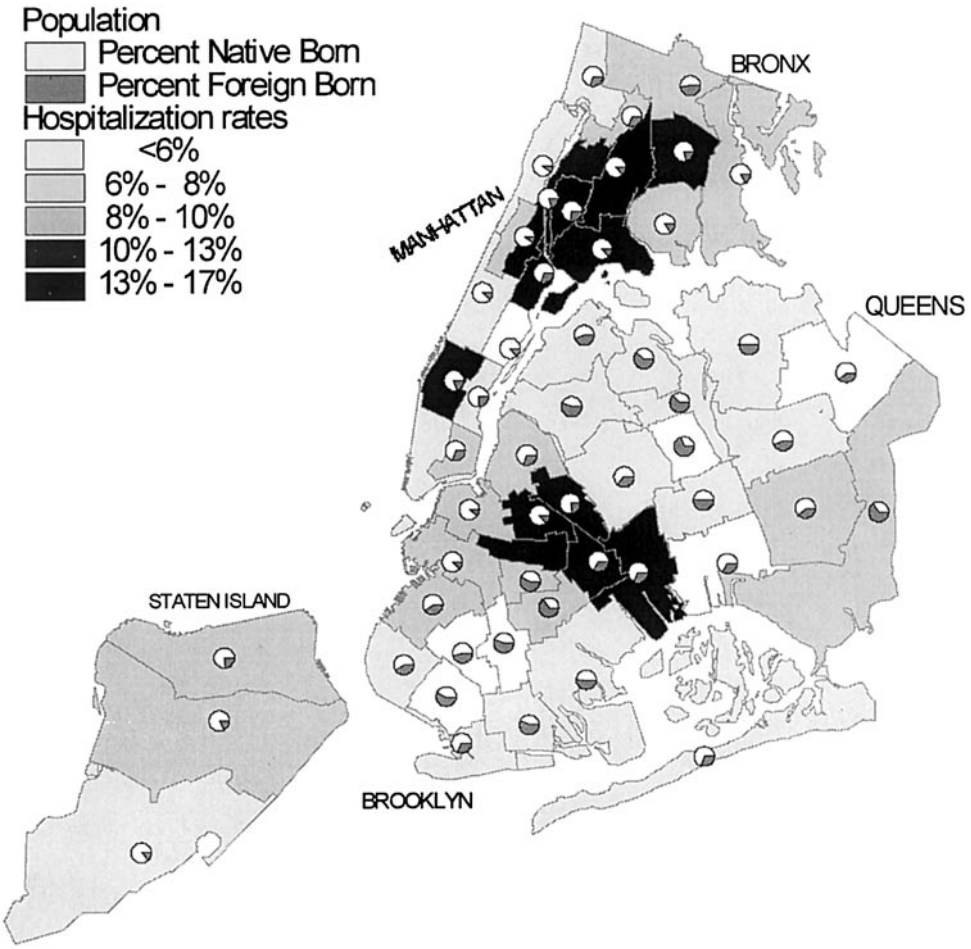

FIG. 1. Hospital rates and the percentage foreign-born in New York City neighborhoods, 1996. (Source: United States Bureau of Census; Housing and Vacancy Survey, 1996; and the Statewide Planning and Research Cooperative System, 1996.)

ilar in neighborhoods with high and low proportions of foreign-born persons.

Table 3 lists the results of the multivariate analyses. After controlling for covariates, U.S.-born persons and Puerto Rican-born persons were more likely to be hospitalized than foreign-born persons; however, hospitalization rates for Caribbean persons from non-U.S. territories were not significantly lower than average.

TABLE 2

Significant Predictors of Hospitalization in New York City Neighborhoods for 18- to 45-year-olds

Total family income	$r = -0.65$ ($P < 0.001$)
Percentage female (includes hospitalizations for normal births)	$r = 0.70$ ($P < 0.001$)
Percentage White	$r = -0.55$ ($P < 0.01$)
Percentage Hispanic	$r = 0.31$ ($P < 0.01$)
Percentage of households with >1.5 persons per room	$r = 0.25$ ($P < 0.05$)
Percentage of foreign-born (excludes U.S. territories)	
18 to 45 years	$r = -0.27$ ($P < 0.05$)
25 to 45 years	$r = -0.35$ ($P < 0.05$)

When income, gender, race, and ethnicity are not accounted for, the risk of hospitalization for U.S.-born persons was not statistically significant in the base-case analysis. This was true in the subanalysis of 18- to 25-year-old persons but not in the 25- to 45-year-old subgroup, suggesting that younger foreign-born persons may be at greater risk of hospitalization than older foreign-born persons relative to native-born persons. Controlling for Asian race had little impact on the association between the total number of foreign-born persons residing in a neighborhood and the hospitalization rate.

The factors we studied explained approximately 69% of the variation in the rate of hospitalization between neighborhoods, with income accounting for over 54% of the hospitalization rate and the percentage of foreign-born persons explaining almost 10% of the variation.

Hospitalization among Persons Aged 45 to 65

In univariate analyses, the direction, magnitude, and significance of the determinants of hospitalization

TABLE 3

Determinants of Hospitalization Rates for Neighborhoods by Proportion of Residents 18–45 Years of Age Who Are Foreign-Born, Native-Born, or Born in United States' Territories

	Slope (β)	P value	R^2
Models using only the following variables			
Foreign-born	−0.06	0.02*	0.09
Born in the continental United States	0.04	0.12*	0.05
Born in Puerto Rico	0.37	<0.0001*	0.40
Models controlling for income, gender, race, and ethnicity and separately adding the following variables			
Foreign-born	−0.08	0.0001*	0.69
Controlling for Asian race	−0.07	0.001*	0.64
Born in non-U.S. Caribbean	−0.04	0.06	0.61
Born in continental U.S.	0.61	0.008*	0.63
Born in Puerto Rico	0.23	0.0018*	0.65

* Statistically significant at $P < 0.05$.

for persons aged 45–65 were similar to those for the 18- to 25- and 18- to 45-year-old groups. When controlling for gender, income, and race in multivariable models, the percentage of foreign-born persons aged 45 to 65 was negatively associated with the rate of hospitalization ($\beta = -0.082$; $P < 0.0001$). The risk factors we examined accounted for approximately 61% of the factors leading to hospitalization. As in the base-case analysis, the percentage of Puerto Ricans in a neighborhood predicted significantly higher hospitalization rates ($\beta = 0.13$; $P = 0.001$), as did the percentage of persons born in the continental United States ($\beta = 0.067$; $P = 0.003$), when covariates were included in the model. After removing covariates, the relationship remained significant.

Hospitalizations among Persons Aged 65 and Over

There were no significant differences in hospitalization rates between neighborhoods when only persons over the age of 65 were examined. This held true when we attempted to control for race, income, and gender

Costs

In 1996, hospitalization charges for persons 18 to 45 were approximately 3.5 billion dollars. Foreign-born persons may have reduced adjusted hospital costs by $300 million dollars in 1996 (95% confidence interval $291 million to $323 million). Unadjusted savings (charges) were $720 million dollars.

The differential in hospital costs between U.S.-born and foreign-born hospitalization patterns of persons in the 45- to 65-year age group was greater than in the 18- to 45-year age group, amounting to $311 million (95% confidence interval $219 million to $382 million) on total charges of $3.2 billion. Unadjusted savings were $747 million dollars. For persons 65 and over, no savings were predicted. Total predicted savings in societal costs from reduced hospitalizations among the foreign-born for persons 18 to 65 years amounted to $611 million dollars in 1996.

Mortality Rates

Foreign-born persons have lower age-standardized rates of death, a longer life expectancy, and fewer years of life lost to disease than U.S.-born persons (see Table 4). In 1990, foreign-born persons lived approximately 4 years longer than U.S.-born persons and 6 years longer than Puerto Ricans at 1 year of age. The mortality rate for foreign-born persons between the ages of 1 and 25 years of age was not significantly different from rates reported for U.S.-born persons, however.

Persons born in territories of the United States residing in New York City appear to be at greater risk of death than persons born in the United States when all age groups are considered together. However, after the age of 45, the risk of death is roughly comparable to persons born in the continental United States and Hawaii.

DISCUSSION

Given the lower hospitalization and mortality rates among foreign-born persons living in New York, the foreign-born appear to be in better health than U.S.-born New Yorkers. Hospitalization rates for cancer, circulatory disorders, mental illness, neurological con-

TABLE 4

1990 Mortality Rates per 100,000 Persons by Country of Birth, New York City

	U.S.	U.S. territory	Foreign
Age (years)			
1 to 25	72	123	102
25 to 45	405	694*	197*
45 to 65	1086	1065	533*
65 to 75	2591	2465*	1853*
75+	6865	6757*	8800*
ASR[a]	965	1054*	841*
Risk ratio			
1 to 25[b]	—	1.71	1.42
25 to 45	—	1.71	0.49
45 to 65	—	0.99	0.49
65 to 75	—	0.95	0.72
75+	—	0.98	1.28
ASR*	—	1.08	0.86
Life expectancy at 1 year of age	72	69	76

* Statistically significant ($P < 0.05$).

[a] Age-standardized rate using the 1990 New York City population as a standard population.

[b] The risk of death for persons born in United States territories and foreign-born persons relative to native-born persons.

ditions, and infectious disease all decline as the percentage of foreign-born persons in a neighborhood increases and this trend continues until at least age 65. Despite limited access to ambulatory and preventive care services [*3,4,9–11*], which may lead to higher admission rates [*3*], hospital costs for the foreign-born were less than among the U.S.-born. Overall cost savings from reduced hospital utilization amounted to $611 million.

The overall societal savings reflect costs associated with the production and delivery of medical products and services, but do not include hospital profits. Since federal payors exclude profits when reimbursing hospitals, societal costs better reflect the fiscal burden of hospital costs in the public sector than hospital charges.

The lower hospitalization and mortality rates among foreign-born groups may in part be due to selection factors among immigrant groups, since legal immigrants must undergo a medical examination (to rule out excludable conditions, mostly active infectious diseases) prior to entry into the United States, must be healthy enough to travel, and may also come from countries with lower rates of chronic disease [*5–7,19*].

Three distinct factors may contribute to the higher rates of mortality and comparable rates of morbidity in foreign-born persons over the age of 65 we observed. First, foreign-born persons may experience a decline in health status as they become acculturated and are exposed to risk factors for chronic disease, such as a poor diet, poor housing conditions, and crime. Second, there are clear demographic differences in the various age cohorts we studied with younger persons mostly having arrived from developing countries and older persons predominantly having arrived from Western Europe, where the rate of chronic disease is generally higher [*20*]. Finally, because younger U.S.-born and Puerto Rico-born persons have higher mortality rates than foreign-born persons, only the healthiest members of these two groups live past age 75, resulting in comparatively lower mortality rates in later years. This "survivor effect" is frequently seen in longitudinal cohort studies [*21*].

There were a number of limitations to our study. First, in constructing life tables, we assumed that life expectancy after age 75 would be similar across countries of birth. This assumption likely resulted in a slight underestimate of the life expectancy of persons born in United States territories and a slight overestimate of the life expectancy of foreign-born persons because of the survivor effect.

There is evidence that the provision of ambulatory care services reduces hospitalization rates [*3*]. Because the foreign-born appear to be healthier than U.S.-born persons, the need for ambulatory care services would likely be lower. Though we were not able to estimate hospitalization costs or savings associated with foreign-born populations for persons under the age of 18 or over the age of 65, it is not likely that hospital costs associated with either age group differ greatly from U.S.-born persons since mortality rates in both of these age groups were similar to U.S.-born persons. The accuracy of our cost estimates, however, was also limited by our inability to calculate per capita hospital charges by sub-borough area. Given that the foreign-born may delay seeking treatment for severe medical conditions leading to unavoidable hospitalization, it is possible that the hospital charges for those foreign-born persons who are actually hospitalized are higher than for U.S.-born persons. These differences in per capita costs were not captured.

Finally, we employed a small area analysis, which is subject to bias. For instance, immigrants tend to live in lower income neighborhoods. Native-born persons residing in these neighborhoods are likely much less healthy than foreign-born persons, but have similar incomes. The presence of low-income native-born persons in a predominantly foreign-born neighborhood would reduce the magnitude of the observed difference in hospitalization rates and costs relative to a nonecological analysis.

Health care is the third largest economic sector in New York City, accounting for more than 13% of all employment and wages and is an economic sector heavily dependent on public funds [*22*]. The health care sector, like virtually all segments of New York's economy, is dependent on foreign-born workers that must be healthy to be productive [*3,23*]. We were not able to add productivity effects to our economic analysis. Were we able to, the projected savings may be higher.

Both the HVS, which was used to calculate hospitalization rates, and the 1990 PUMS, which was used to calculate mortality rates, likely underestimated the number of foreign-born persons (especially undocumented persons), impoverished persons, and racial minority groups [*24*]. We assumed that this underestimate was consistent across sub-borough areas. If this assumption is correct, undercounting would have no effect on the small area analysis since only the proportion of foreign-born persons residing in each sub-borough area was entered into the multiple regression models. However, it is possible that the mortality rates among the foreign-born we observed represent a high estimate since population data are used as the denominator of such rates.

On the other hand, it is possible that lower mortality rates reflect emigration of very ill persons to their country of birth. If severely ill persons return to their homeland to die, this might also lower the overall rate of hospitalization in predominantly foreign-born neighborhoods.

The majority of foreign-born persons are not eligible to receive publicly funded ambulatory or preventive medical services [*3*]. Therefore, it is likely that some of the hospitalizations and deaths counted in predominantly foreign-born neighborhoods were preventable. Our results suggest that the foreign-born residing in New York City are healthier than U.S.-born persons and are consuming fewer health system resources. Arguments that the foreign-born are overutilizing medical services and are thus unfairly and disproportionately draining publicly funded medical resources appear to be unfounded, and legislation based on such arguments should be reexamined.

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